Pumpkin & Squash

ATLANTIC PROVINCES VEGETABLE CROPS GUIDE TO PEST MANAGEMENT 2002 - 2003

Distributed By:
FARM EXTENSION SERVICES
P.E.I. DEPARTMENT OF AGRICULTURE AND FORESTRY

Prince Edward Island
CANADA
Agriculture and Forestry
Farm Extension Services

Publication No. 1400A
Agdex No. 250/600
Published January 2002

Table of contents:

Home Page

Introduction
Crop Establishment
Crop Management
Nutrition
Pests and Pest Control
Harvesting and Handling
Storage and Conditioning
Bibliography
Weeds
Insects
Diseases
Print as PDF

Introduction

All pumpkins and squash are members of Cucurbitaceae (gourd family) as are watermelons, cucumbers, muskmelon and gourds. Botanically there is no distinction between squashes and pumpkins since both pumpkin and squash cultivars are found in these species:

Cucurbita Species	Summer Squash	Winter Squash	Pumpkin	Marrows
C. pepo	X	X	X	X
C. mixta	--	X	X	--
C. moschata	--	X	X	--
C. maxima	--	X	X	X

Pumpkins and squash originated in the Americas and were cultivated by the ancient civilizations of Central and South America over 7000 years ago. All 4 species seem to have originated and been cultivated in different areas of North and South America for many purposes - edible seed, containers and edible fruit.

Summer squash - is the edible fruit of any species of cucurbita (commonly C. pepo) utilized when immature as a table vegetable. The rind and seeds are soft and the vegetable is 100% edible. Winter squash - is the edible fruit of any species of Cucurbita utilized when ripe (usually C. maxima or C. moschata) as a table vegetable or in pies. The flesh is fine grained and of mild flavor so is suitable for baking. The fruits have hard rinds and store well. Pumpkins - are the edible fruit of any species of curcurbita (usually C. pepo) utilized for Halloween, livestock feed or in pies. The flesh is somewhat coarse and may be strongly flavored and is not generally served as a baked vegetable.

Pumpkins and squash are warm season crops which are both cold weather and frost sensitive. They are more cold hardy than cucumbers. The minimum temperature for seed germination is 15°C, with a maximum of 38°C and an optimum range of 20 to 32°C. Best crop growth occurs at 18 to 25°C, with a minimum of 10°C and a maximum of 32°C. Cultivars requiring a long growing season should only be planted in the regions where grain corn can be grown in fields which are sheltered since cold winds are detrimental to growth. Plastic tunnels, row covers and/or plastic ground mulches benefit these crops.

Well drained loams well supplied with organic matter are optimal for early production. Heavier soils may be used, if they are of good structure, for late season and storage production. These fields will usually be rotated from a perennial forage crop the previous growing season.

The market season varies for each type and cultivar of pumpkin and squash.
1) *Summer squash* (mainly zucchini) can be produced from July 1 to Oct. 30 with some use of plastics. Yields may range between 10,000 to 15,000 kg per hectare.
2) *Winter squash* (mainly buttercup) can be produced and marketed from July 20 to May 30. Yields may range from 15,000 to 25,000 kg per hectare depending on the weather, cultivar and storage losses.
3) *Pumpkins* (mainly C. pepo). The bush type tend to be earlier than vine types and start to mature and yellow in mid to late August. The main crop should be mature by September 15th for curing and storage for sales until Halloween. Pumpkins may be stored beyond October 31 but there are only limited markets. Pumpkins vary in yield from 20,000 to 40,000 kg per hectare depending on the weather, cultivar and storage losses.

Squash and pumpkins are mainly sold at roadside or through retail stores. Some go through wholesalers. Squash are stored for roadside and wholesale markets from October to early March or beyond. Hubbard squash store better than most buttercup but the market for this type is not large. Some buttercup cultivars store better and have a much drier texture to the flesh. Markets for winter squash are mainly served from local production but there is some potential to replace winter imports with the use of storage buttercup squash.

Zucchini is the most popular of the summer squashes and its popularity continues to grow. Current marketings are mainly roadside and direct to retail stores. Eventually more market may be available so that wholesale volumes of this crop can be produced.

Pumpkins are marketed mainly at roadside and through retail chain stores. Some get into the wholesale market. There are a great range of size and types of pumpkins so some speciality markets may be developed for certain types for carving, other ornamental or other traditional uses. The market is supplied mainly from local supplies and strength of the market depends on seasonal weather and local plantings. Generally in pumpkins and squash there are limited market potentials to reduce imports, increase consumption and produce specialty products for retail shelves, and for the Hotel, Restaurant & Institutional markets. Some export markets may have development potential. (Pumpkin pie fill is currently imported into Atlantic Canada but no processors have yet developed this market potential.)

Nutrient Content: Excellent source of Vitamin A; good source of Vitamin C; potassium and calcium. Low in sodium. Amount of kilocalories in a serving depends on the type - 250 mL (1 cup) cooked, mashed winter squash contains 137 kilocalories; cooked-diced summer squash contains 27 kilocalories; cooked pumpkin has approximately 79 kilocalories. The seeds are a good source of protein, contain some iron and are high in unsaturated oils. Some cultivars are being grown for the seed or pressed for oil.

Due to the high vitamin A content of pumpkin and squash flesh, consumption will reduce the risk of cancer and heart disease.

Crop Establishment ▲ to Top

Seeding/planting - Do not plant until the soil temperature is at least 16°C. Some types of vegetable seeders and transplanters can be adapted to effective seeding of some cultivars of pumpkin and squash. The seeding rate depends on the seed size, whether it is running or bush type, on the actual spacing and whether transplants are used vs. direct seeding. Do not save your own seed since pollen can travel with bees for over 2 km. Isolation is difficult unless hand pollinated and protected.

For vine types 2 to 5 kg per hectare and bush types 4 to 6 kg per hectare. Space rows 1.5 to 2 m for buttercup, 2 to 2.5 m apart for pumpkins and hubbards, and 1 to 1.5 m apart for bush pumpkins and summer bush squash. Plants should be spaced at 0.5 to 1 m for buttercup, 1 m for pumpkin and hubbards, and 0.6 to 0.9 m for bush pumpkins and summer squash. The depth of seeding should be 25 to 30 mm.

Generally thinning is less critical than with most vegetable crops since higher plant populations usually result in smaller fruit but similar yields.

For transplants seed two to four weeks before field setting in individual containers such as peat pots, peat blocks or peat pellets. Some growers use cellular trays of 24 to 125 cells. The roots must not be disturbed at transplanting or slow establishment will result. Do not transplant until the danger of frost is low and soil temperature is over 15°C. Plastic row covers or walk-in tunnels are being used by roadside marketers and specialty crop growers to capture more market

early in the season and then later in the fall for zucchini. Transplants can be protected by the use of windbreaks such as rye strips and small sheltered fields.

Crop Management ▲ to Top

Plastics - For direct seeded or transplanted pumpkins or squash black or clear ground mulch, hot caps, plastic row covers, and/or tunnel houses can be used effectively to get early production. Economics dictate what is feasible for each type of cultivar for specific markets. Tender transplants must be protected from wind injury.

Pollination - This is an important concern for a good set of high quality fruit. On winter squash and pumpkin, fruit set takes place over a 2 to 3 week period. Inadequate pollination results in poorly shaped fruit as well as excessive blossom drop. One colony of honey bees per hectare is suggested. Most insecticides will poison bees so take precautions.

In contrast to open pollinated varieties, most of the summer squash tend to develop female flowers before the male flowers appear, especially in cool weather. As a result some of the earliest flowers may not be fertilized unless there is another source of pollen. Unfertilized fruits may enlarge somewhat, but seldom reach marketable size, shape or quality. Parthenocarpic cultivars are being developed.

Irrigation - These crops under moisture stress are generally responsive to irrigation especially from the time of fruit set to harvest. When using row covers, tunnel houses or hot caps fixed irrigation systems can help prevent frost damage. Over irrigation or poor timing with humid weather can greatly aggravate white mold (sclerotinia).

Nutrition ▲ to Top

ALL ADDITIONS OF LIME AND FERTILIZER OR MANURES SHOULD BE BASED ON RECOMMENDATIONS FROM A SOIL TEST.

Pumpkins and squash usually respond well to applications of 20 to 40 tonnes of manure per hectare. Otherwise a green manure crop or sod plow down is desirable. When a limited amount of manure is available 8 to 10 tonnes may be buried beneath the seed row.

Lime - Lime should be applied to maintain the soil pH between 6.0 and 7.0.

Nitrogen - One-half of the nitrogen (60 kg) is usually applied at planting time unless the soil is low in P and K and large amounts of fertilizer need to be applied. The remainder of the nitrogen (60 kg) is sidedressed just as the vines begin to run for winter squash and pumpkins (early July) and when bush squash have developed sizable plants (late June). A second sidedress may be needed on sandy soils which have been leached by high rainfall. Foliar applications of nitrogen are possible especially on summer squash which are being intensively

cropped.

Phosphorus - Banded fertilizer would be effective in reducing the needed phosphorous. Use plant starter (with high phosphorus) on transplants for early crops.

Potash - The requirement for this nutrient is not high especially if good quality manure is applied. Do not band potash (if possible) but broadcast and harrow it into the soil preplant. If potash is banded do not apply more than 100 kg of N plus potash per hectare.

Magnesium - If soil magnesium levels are low, a fertilizer containing magnesium may be used. Foliar sprays may also be used.

Sulfur - On sandy soils low in organic matter that have been intensively cropped, soil sulphate levels may be low. Application of gypsum should be considered on these soils.

Application Method - Up to 100 kg of (N + K) per hectare can be applied in a band, 5 cm to the side and 5 cm below the seed at planting with the remainder of the fertilizer broadcast and incorporated before planting. Nitrogen may also be sidedressed or applied to the foliage. When using plastics, nitrogen sidedressing can be reduced since leaching is minimized. Also, fertility can be applied through trickle irrigation or overhead irrigation.

Pests and Pest Control ▲ to Top

Weeds

Successful weed control in squash and pumpkins is possible by integrating chemical and cultural techniques. These crops should be planted to land free of perennial weeds, where the annual weed seed population has been reduced through previous cropping and tillage prior to planting. Recommended herbicides may not provide control for the entire season, therefore cultivation may be necessary. Avoid fields where residual herbicides from previous years persist in the soil as crop injury may occur.

Weeds can be controlled in squash and pumpkin by planting seed or transplants in opaque plastic mulch. Consult your local agriculture office for information on weed control between the rows of plastic mulch.

A stale seedbed technique may be used for direct seeding or transplants.

Diseases

Alternaria and Septoria Leaf Spot (fungi)

Characteristics: *Alternaria* causes small circular spots which enlarge up to 2 cm in diameter with dark concentric rings within the spots. Spots may coalesce to

affect larger areas of the leaf. Black sunken lesions may occur on the fruit. *Septoria* causes numerous small lesions with white centers which may lead to defoliation. These fungi will overwinter in soil for one season and possibly 2 years. Both probably are seed borne as well.

Control: Treat seed and rotate with non-cucurbit crops. Apply appropriate fungicides at first sign of the leaf spots and at 7 to 10 day intervals.

Black Rot and Gummy Stem Blight (fungi)

Characteristics: Both are caused by the same fungus. When the fungus is seed borne it causes damping-off which usually kills the seedlings. On older plants it spots the fruit, foliage, petioles and stems. On fruit the spots are circular, yellow to light green in color eventually turning gray to brown to finally black. Spots on leaves are pale brown, while those on stems form streaks having an amber exudate. The fruit rot phase often develops on stored pumpkins and squash. The fungus overwinters in seed and residue from diseased plants.

Control: Plow down refuse immediately after harvest. Follow at least a two year rotation. Apply fungicides at first sign of disease and at 7 to 10 day intervals. Post harvest fruit rots can be reduced by careful handling, curing and storage temperature control.

Powdery Mildew (fungus)

Characteristics: Appears as a white powdery growth on leaves which may cause the leaves to wither and die. It is favored by high temperatures.

Control: Apply appropriate fungicides at first sign of disease and at 7 to 10 day intervals.

Fruit Rots in Storage (fungi)

Characteristics: A number of diseases attack pumpkins and squash in storage. *Black rot, Sclerotinia, Alternaria, Rhizopus, Botrytis, Fusarium, Penicillium* and *Cladosporium.* All may occur as fruit rots in storage. Rots can originate from actual fruit infection in the field or from a dusting of fungus spores that later infect the fruits in storage.

Control: Involves the season long practices of seed treatment, good field drainage, rotation, insect control, fungicide sprays, harvest care and especially post harvest storage temperature and humidity control. Harvest only mature fruits, prior to frost or chilling temperatures and cure properly and store at 7.5 to 13°C. Sclerotinia can be induced by over irrigation during hot humid weather conditions, especially during full bloom. Do not store pumpkin or squash that have come from a field with a high incidence of sclerotinia.

Virus Diseases

A number of diseases affect squash and pumpkins and the symptoms are often similar. Cucumber mosaic is the most common virus disease. CMV affects many vegetables and other plants not related to squash and pumpkins. Younger leaves develop a dark green, yellow mottled and wrinkled look. Older leaves may gradually turn yellow and die but in many plants these leaves stay green and only the younger ones have mosaic symptoms. Yellow warts may form on the fruit.

Control: Eliminate weed hosts and apply insecticides to control aphids.

Insects

Seedcorn Maggots

Characteristics: Small yellowish-white maggots 6 mm long with a pointed head end. The adult is a small grayish-brown fly. Maggots feed on seed, causing seed to produce a poor plant, and will also feed on roots, causing poor plant growth. Seedcorn maggots attack deeply planted seeds.

Control: Plant as shallow as needed in a well prepared seedbed. Early germination is necessary to get good plant stands and prevent injury. Later planted crops are not as susceptible to this pest. Good weather conditions are necessary to completely control the pest. Avoid planting susceptible crops in fields very recently manured. Chemical seed treatment is essential.

Striped Cucumber Beetle

Characteristics: The striped cucumber beetle overwinters in the adult stage under leaves or dense grass, emerging in May or early June. The adult is 5 mm long. Its upper surface is about equally black and yellow, with the folded wing covers bearing three black stripes. Two weeks after emerging the beetles mate and lay eggs. The orange-yellow eggs are laid in the soil at the base of host plants and hatch within 10 days. Upon hatching, the larvae burrow into the soil and start to feed on roots. About the first of August the larvae pupate in the soil. Two weeks later, a new generation of beetles appear. In Canada, there is only a single generation per year. They are a carrier of bacterial wilt.

Control: Apply insecticides when insects first appear and repeat as necessary.

Flea Beetle

Characteristics: Flea beetle adults are 1.5 to 3 mm long, black or bronze beetles. Their hind legs are well developed for jumping. The white larvae are in the soil, and therefore seldom seen. Depending on species, there are one or two generations a year. Adults overwinter in the soil. They emerge early in the spring and feed on young plants. Eggs are laid on or near the roots where larvae feed. Mature larvae pupate in the soil near the host plant. Adults emerge in early August for single-generation species. Last-generation adults feed on foliage until fall, when they return to the soil to overwinter.

Control: Heavy damage can occur quickly, usually under hot humid weather conditions, just after crop emergence from the soil. Apply insecticides only if insect populations are high

SPECIFIC CHEMICAL CONTROLS FOR THE VARIOUS CROP PESTS DISCUSSED MAY BE FOUND IN THE "GUIDE TO PEST MANAGEMENT" FOR VEGETABLE CROPS.

Harvesting and Handling ▲ to Top

Winter Squash - Harvest for roadside begins when maturity is reached. That is when the fruit sizes up and then takes on a dull waxy appearance. For storage harvest should take place before the vines are frosted. The stems should be cut to 50 mm in length. This step will aid in a quick curing process, and fungal infection of the fruit by means of the stem will be avoided. (Plant only long storing buttercup cultivars such as "Delica".) Place fruit in appropriate bulk bins which will give good air circulation in the curing process. In bright sunshine sun burn can occur on harvested fruit. Market size is generally 1 to 3 kg.

Pumpkins - Harvest with appropriate sized handles 5 to 10 cm before the first frost into bulk bins. Proper curing and storage maintains good handles, faster ripening, and better color. If necessary, pumpkins can be harvested if some color is present. These fruits are easily damaged by rough handling.

Summer Squash (Zucchini) - This vegetable is harvested immature approximately 180 mm in length with an approximate diameter of 50 mm (approximately 10 per kg). Some markets may call for smaller sizes. A sharp knife is required for harvest. Harvest is at 1 to 3 day intervals. Fruit should be removed from the plant as this increases the plants productive life and marketable yields.

Storage and Conditioning ▲ to Top

Winter Squash - The storage life of winter squash ranges from 2 to 6 months depending on the cultivar. Most cultivars of winter squash store longer than pumpkin cultivars. After curing, for about 2 weeks, at 27 to 30ºC, maintain the storage at 7.5 to 13ºC and at 60 to 75% relative humidity. Curing hardens the shell, heals superficial wounds, reduces the water content of the fruit and thereby improves the eating quality of most cultivars. A temperature of 2ºC for 30 days will result in chilling injury, exhibited by increased rot, when removed from storage to room temperature. Hubbard and butternut squash can be kept more than 6 months. Certain buttercup cultivars can be kept more than 5 months. Squash should not be stored with high ethylene producers since they will turn color, become stringy and decay. Curing acorn type squashes decreases the storage life and eating quality.

Pumpkins - Conditions for curing and storage are similar to those for winter squash. Pumpkins at 10ºC to 13ºC can be held for 2 to 3 months.

Summer squash - These fruit are soft skinned and highly perishable and should be

cooled immediately following harvest. Held at 5°C to 10°C and a relative humidity of 95%, summer squash can be stored up to 2 weeks.

Bibliography ▲ to Top

(See also General References)

Agriculture Canada Insect Identification Sheet #48.Bate, E. 1980.

Vegetable Marrows and Courgettes. A.D.A.S./M.A.F.F. Publication 216. Alnwick, U.K. 8 pp.

Isenberg, F. M. R. and J. R. Hicks 1978. Storage of Winter Squash. Cornell University, Ithaca, N.Y. 3 pp.

Wood, R. J. 1981. Buttercup Squash Cultural Techniques. Hort. Prod. & Practice, Min. of Agr. & Fisheries. Wellington, New Zealand. 4 pp.

Year of the Pumpkin. 1992. The National Garden Bureau. 6 pp.

Diseases and Pests of Vegetable Crops in Canada. 1994.

Canadian Phytopathological Society and Entomological Society of Canada. pp 124 to 135 and pp 438 to 439.

Jansen, M. 1995. Vine Crops (selected references and abstracts) Vegetable & Potato Producers Association of Nova Scotia. Kentville Agricultural Centre. 140 pp.

Prepared by: Horticulture Section, Production Technology Branch, Nova Scotia Department of Agriculture & Marketing on behalf of APASCC and members:

▲ to Top

PEST	PESTICIDE (Formulation)	RATE Product	DAYS TO HARVEST	REMARKS
Weeds ▲ to Top				
Preplant Perennial Weeds including quackgrass	ROUNDUP 356 Sn	2.5 to 7.0 L/ha	-	Apply in the fall or spring prior to planting. Annual weed control programs will be necessary to control weeds germinating after planting. For quackgrass control apply to actively growing quackgrass when at least 4 new leaves are present. The low rate (2.5 L/ha) will provide a minimum of one season control, while higher rates (4.75 to 7 L/ha) will provide longer term control. The low rate of Roundup should be applied in 50 to 100 L/ha water. If higher water volumes are used add a suitable surfactant. Wait 72 hours before plowing
	TOUCHDOWN 480	2.5 to 7.0 L/ha	-	
	GLYFOS	2.5 to 7.0 L/ha	-	
	ROUNDUP	2.5 to 7.0	-	

	TRANSORB	L/ha		under. Best control of quackgrass is obtained when these herbicides are applied in the fall.
Preemergence Stale Seedbed Technique	GRAMOXONE 200 Sn	2.75 to 5.5 L/ha	-	Apply in 300 to 1100 L of water/ha to foliage of the emerged weeds but before the crop has emerged. Use Gramoxone for best control of grasses.
	REGLONE 200 Sn	2.75 to 5.5 L/ha	-	
Germinating annuals	ALANAP 240 SN	11.0 to 30.0 L/ha	-	Apply preemergence immediately after seeding. Do not use on butternut squash or pumpkin. Irrigation will improve control if soil is dry. Use low rates on sandy soil.
Postemergence Inter-row shielded	GRAMOXONE 200 Sn	2.75 to 5.5 L/ha	-	Do not spray solution on the crop plant since it could be injured or killed. Use Gramoxone for best control of grasses.
	REGLONE 200 Sn	2.75 to 5.5 L/ha	-	
Grass Weeds	POAST ULTRA	1.1 l/ha	30	Add 0.5 to 1.0% v/v Merge Surfactant.
Insects ▲ to Top				
Seedcorn maggots			-	See - "Seed Treatment".
Cucumber beetle Flea beetle	METHOXYCHLOR 50 WP	1.7 to 5.0 kg/ha	1	Apply at first sign of infestation. Repeat at 7 to 10 day intervals as necessary. Cucumber beetles may transmit bacterial wilt disease.
	THIODAN 4 EC	1.5 L/ha	2	
	ENDOSULFAN 50 WP	1.1 kg/ha	2	
	THIODAN 50 WP	1.0 kg/ha	2	
	SEVIN 85 WP	1.75 kg/ha	3	
	SEVIN 80 SP	1.5 kg/ha	3	
	SEVIN 50 WP	2.25 kg/ha	3	
	SEVIN XLR 43 SU	2.5 L/ha	3	
	SEVIN L 420 SU	2.5 L/ha	3	
	GUTHION 50 WP	1.1 kg/ha	14	
	SNIPER 50 WP	1.1 kg/ha	-	
	DIAZINON 500	1.1 to 2.0 L	3	
Mites	KELTHANE 50W	1.0 to 1.5 kg/ha	7	Use low rate on small plants and high rate on large plants. Do not mix with high alkaline solutions.
Diseases ▲ to Top				
Alternaria leaf spot, Anthracnose, Downy mildew, scab, Gummy stem blight	MANEB 80 WP	1.1 to 3.25 kg/ha	14	Begin applications when runners begin to form or at first sign of disease, and then at 7 to 10 day intervals. MANEB and DYRENE are not registered for scab
	DITHANE M-22	1.1 to	14	

	80 WP	3.25 kg/ha		control.
	DITHANE 75 DG	1.1 to 3.25 kg/ha	14	
	PENNCOZEB 75 DF	1.1 to 3.25 kg/ha	14	
	DITHANE M-45 80 WP	2.25 to 3.25 kg/ha	14	
	MANZATE 200 80 WP	2.25 to 3.25 kg/ha	14	
	DYRENE 50 WP	2.5 to 3.75 kg/ha	1	
	BRAVO 500 F	3.2 to 4.8 L/ha	1	-
	MANZATE 200 80 WP plus BENLATE 50 WP	2.25 kg/ha 550 to 850 g/ha	14	The tank mix of Manzate 200 with Benlate in addition to providing powdery mildew control, may also improve control of some of the other diseases listed.
Powdery mildew	BRAVO 500 F	4.8 L/ha	1	Begin application at first sign of disease and then at 7 to 10 day intervals.
	MANZATE 200 80 WP plus BENLATE 50 WP	2.25 kg/ha 500 to 850 g/ha	14	
Septoria leaf spot	MANEB 80 WP	1.1 to 3.25 kg/ha	14	Begin application at first sign of disease and then at 7 to 10 day intervals.
	DITHANE M-22 80 WP	1.1 to 3.25 kg/ha	14	
	ZINEB 80 WP	2.25 kg/ha	5	